

# **USA-SRB Materials Replacement Shuttle Environmental Assurance Initiative**

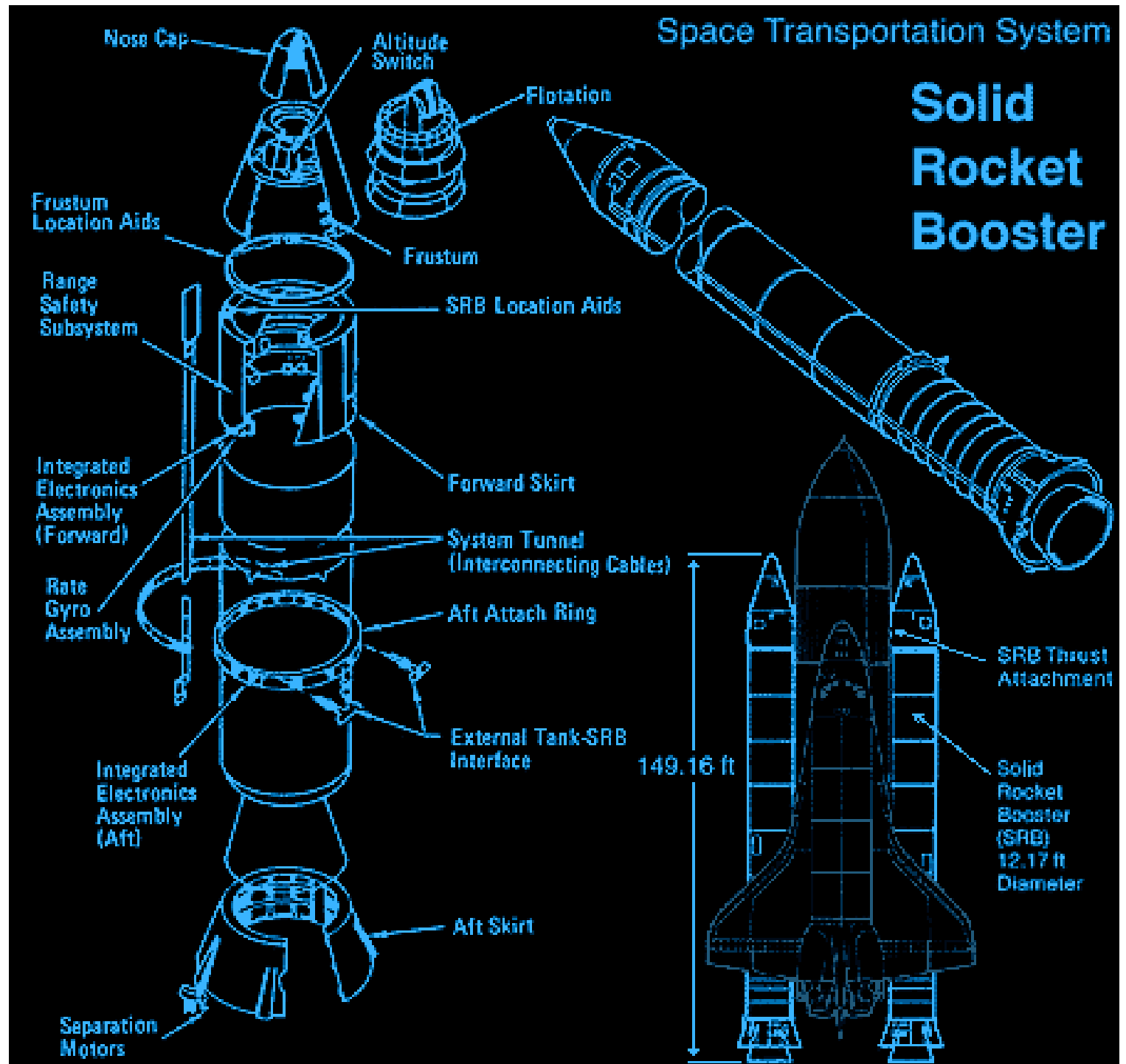
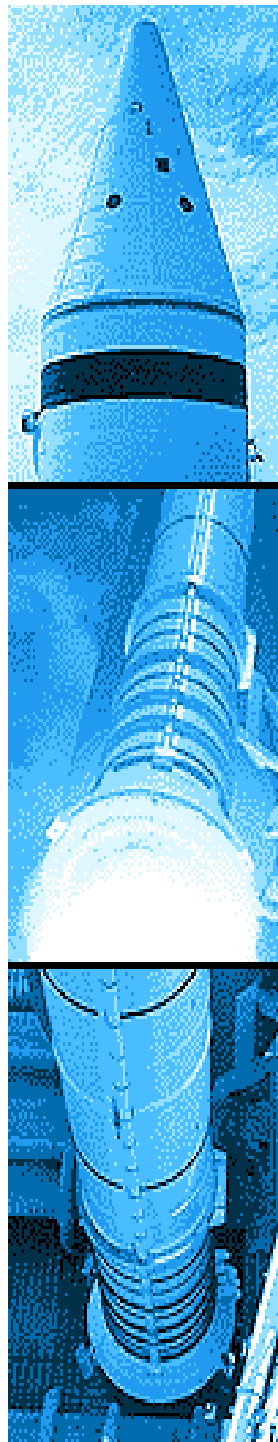
**David Eckols**

September 14, 2004



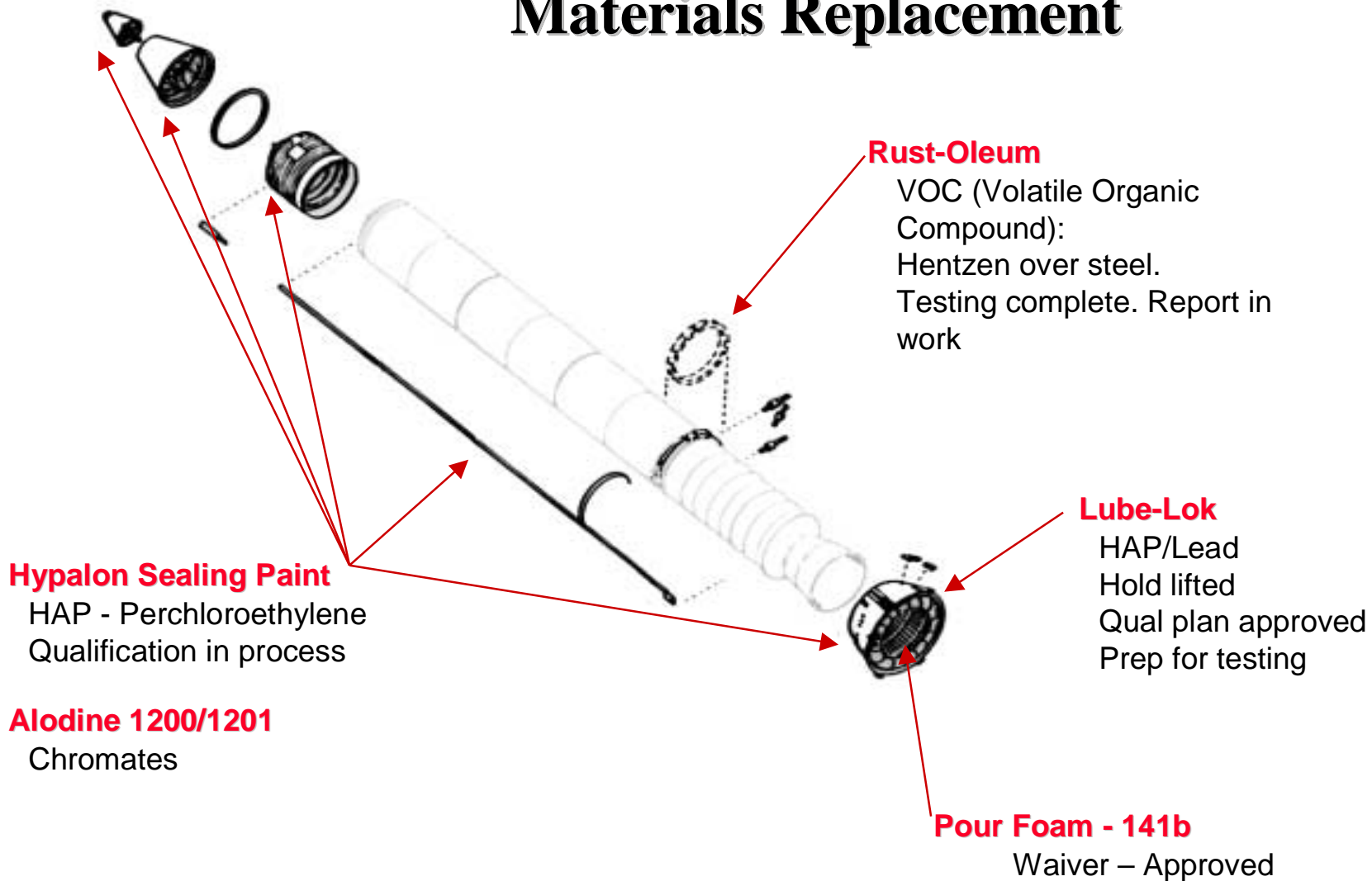
# Space Shuttle Program





# SOLID ROCKET BOOSTER

## Materials Replacement



## **Alodine 1200/1201 to 5200/5700**

- New Alodine products are Non-Hazardous (Have no chromates therefore the current largest waste stream at USA SRB Element, Alodine 1200/1201, has been eliminated)
- SRB aluminum hardware alloys protected by Alodine 1201 include 2219 aluminum or Alclad 7075.
- Alodine is an environmental concern for chromium that enhances “corrosion protection” and “primer adhesion” of aluminum surfaces
- All shuttle elements utilize chromate conversion coatings and usage varies

# Alodine 1200/1201 to 5200/5700

- Alodine at KSC is stocked/used per (6) contractor/commercial specifications, all governed by the same Military Specs C-81706 & C-5541 (common material)
- The Space Shuttle Program can benefit from capitalizing on vast amounts of resources being spent by the major users/producers of conversion coatings (DOD, Aircraft - Boeing and Commercial Industry)

<u>PROJECT</u>	<u>Conv. Ctg. gal./year</u>	<u>Waste Water lbs./year</u> <b><i>Disposal cost \$0.20/lb.</i></b>	<u>Sq. Feet coverage</u>
ET	<b><i>11,000</i></b>	None	25,000
SRB	453	<b><i>96,000</i></b>	2,200
RSRM	168	1,760	451
SSME	15		
Orbiter	60 = Calif., 10 = KSC	None	Refurb, Touch-up
KSC Non-Flight	385	1,000	6,240

# Hentzen Over Steel



**External Tank Attachment Ring  
Section (ETAR)**

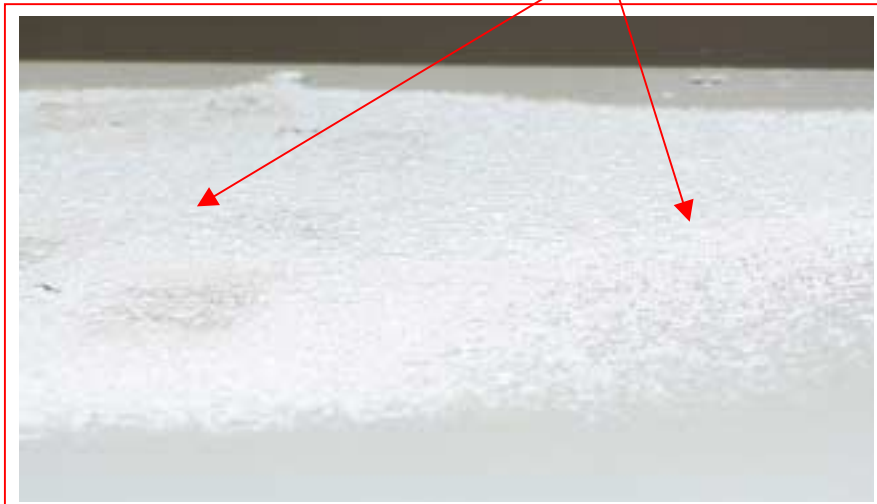
# Hentzen Over Steel

**Objective:** Provide an universal paint for aluminum and steel hardware.

**Benefit:** One paint system for all SRB metals. Improves logistics and environmental compliance.

**Schedule:** Testing in work. Implementation on hold pending Hot Gas testing (RTF impact) and receiving issues

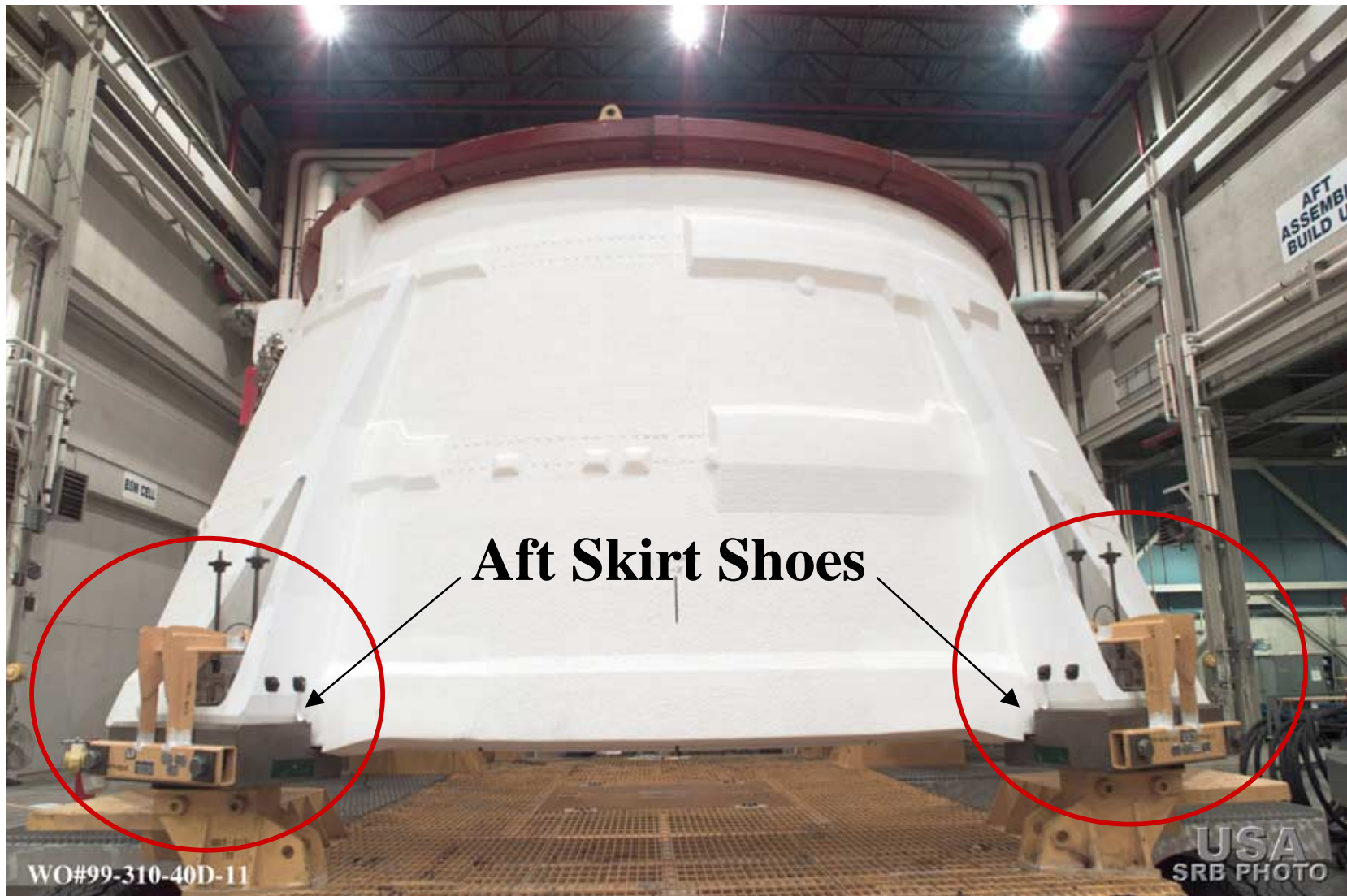
Raised Topcoat on Back side of panel after Hot Gas Testing (ascent and decent profile)



- Vacuum Oven testing can not duplicate condition.
- Qual/Sensitivity Report pending receipt of Hot Gas Test results (addressing debris issue).
- Additional testing scheduled to evaluate Hot Gas results in the ascent environment.



# Dry Film Lube



# **Dry Film Lube Status**

## ***Issues:***

- **Current Lubricants utilize Lead containing Base coat and requires a High temperature cure. (1000F)**
- **Current environmental application requirements are a constraint to processing parts in Florida at certain times of the year.**
- **Reduced personnel hazards due to lead application and removal**
- **High levels of Volatile Organic solvents**

## ***Benefits:***

- **More Environmentally Friendly- Lead Free**
- **Reduced Corrosion Potential- Reduced graphite**
- **Spray Application process**
- **Lower Cure Temperatures**
- **Reduction of VOC (Volatile Organic Content)**
- **Less Sensitive application requirements**
- **Reduced Personnel exposure to lead**

# Dry Film Lube Status

## **Objective: Remove lead from dry film process**

- The Qualification plan has been approved by MSFC
  - Testing interrupted by RTF activities
  - The key objective is to remove the lead component from the process
- 10 test candidate material panels are under test evaluation in parallel with qualification testing
- Testing will include:
  - Monoball -Both 2006 and 1000X from both EM and USA process
  - Falex Block on Ring ASTM D2714. Both 2006 and 1000X from both EM and USA process
  - Coating Adhesion- 2006
  - Fluid Compatibility -2006
  - Corrosion Protection both Atmospheric and Immersion - Both 2006 and 1000X lubricants

# Dry Film Lube Summary

<b>Issues</b>	<b>Current System Lube-Lok 1000x</b>	<b>New Lubricant</b>
<b>Corrosion Prevention</b>	<b>Graphite Corrosion Concern</b>	<b>Reduced corrosion potential</b>
<b>Hazardous Waste Disposal</b>	<b>Hazardous Lead Waste Generation</b>	<b>Eliminates Lead Waste</b>
<b>Personnel Safety</b>	<b>No Reduction in Current Levels of Lead Mitigation</b>	<b>Elimination of Current Lead Exposure Levels</b>
<b>Volatile Organic Compounds</b>	<b>No Reduction in Current Levels</b>	<b>Potential for reduced VOC</b>
<b>Improved Performance</b>	<b>Traditional Performance</b>	<b>Reduced Environmental Application Constraints</b>

# Hypalon Status



# **Hypalon Status**

## **Objective: Replace Perchloroethylene**

- **Qualification testing Status**
  - Qualification panel fabrication completed
  - Pre-Qualification Hot Gas Testing interrupted by RTF
  - Beach Exposure Panels removed from KSC Beach Site
- **Estimated Completion**
  - Qualification: 2005
  - Implementation: 2006

# Rust-Oleum Status





## Pour Foam - 141b Status



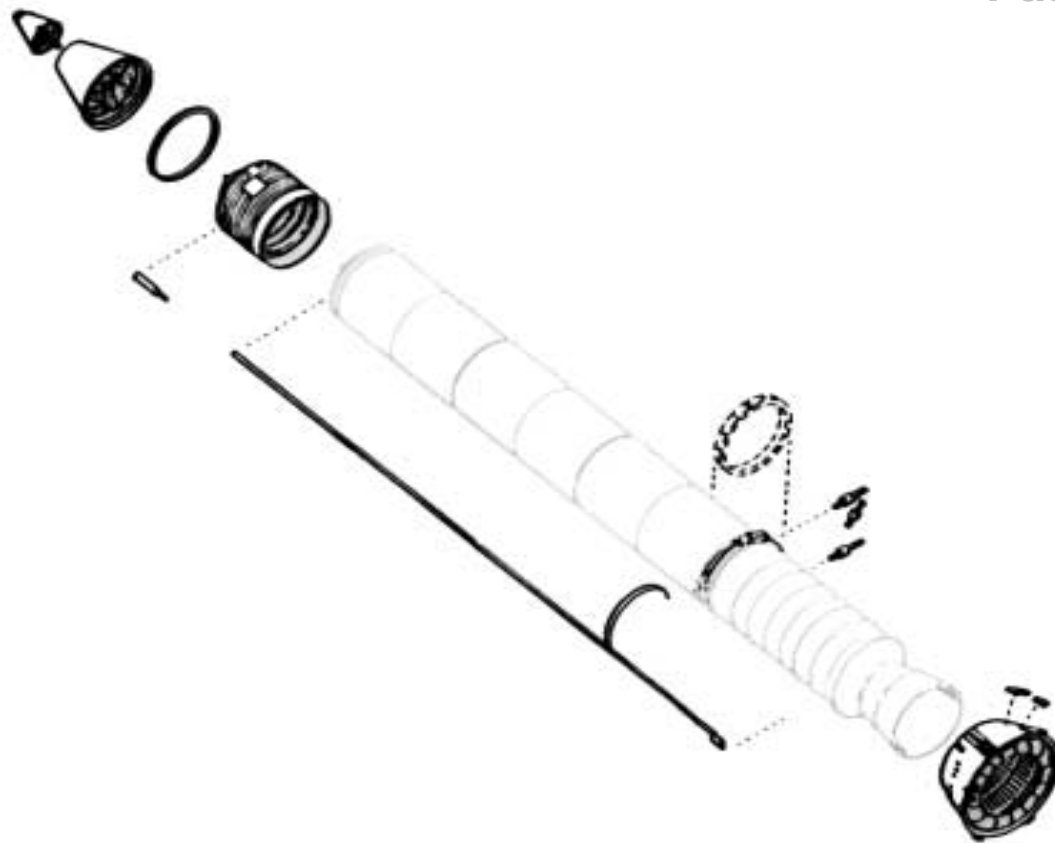
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USA  
SRE PHOTO



# SOLID ROCKET BOOSTER

## Materials Replacement



### Past Material Replacements

1995 1,1,1-Trichloroethane - Spirit 126  
1995 HD Conoco/Trich sol - LPS3  
1995 MSA-2 – MCC-1 (eliminated methylenechloride, perchloroethylene and hazardous waste)  
1995 Hypalon – 1,1,1 Trichloroethane Free Hypalon  
1996 Akzo - Deft  
1996 - Replaced Freon in the Insta-Foam process by Freon HCFC-141b  
1998 PR-1422 - Reduced by 90%  
1998 MEK/Toluene - Acetone/DS-104  
2000 K5NA - RT 455 eliminated human mutagen  
2002 Alodine 1201 – Alodine 5700  
2002 Deft – Hentzen Coating System